A second form of the invention is a device for controlling a damping force of a damper. The device includes means for determining a first operating current as a function of a desired force level of the damping force, means for determining a temperature compensation as a function of an operating temperature of the damper, and means for applying the temperature compensation to the first operating current to generate a second operating current as a function of both the desired force level of the damping force and the operating temperature of the damper.

A third form of the invention is a system comprising a damper and a controller. The controller includes means for determining a first operating current as a function of a desired force level of a damping force of the damper, means for determining a temperature compensation as a function of an operating temperature of the damper, and means for applying the temperature compensation to the first operating current to generate a second operating current as a function of both the desired force level of the damping force and the operating temperature of the damper.

The foregoing forms, and other forms, features and advantages of the present invention will become further apparent from the following detailed description of the presently preferred embodiments, read in conjunction with the accompanying drawings. The detailed description and drawings are merely illustrative of the present invention rather than limiting, the scope of the present invention being defined by the appended claims and equivalents thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an illustration of a MR damper as known in the art;

FIG. 2 is an illustration of a block diagram of a MR damper controller in accordance with the present invention;

FIG. 3A is an illustration of a first exemplary force-velocity curve of the MR damper of FIG. 1;

FIG. 3B is an illustration of a second exemplary force-velocity curve of the MR damper of FIG. 1;

FIG. 3C is an illustration of a third exemplary force-velocity curve of the MR damper of FIG. 1;

FIG. 4 is an illustration of a block diagram of a first embodiment of a temperature detection module in accordance with the present invention;

FIG. 5A is an illustration of a block diagram of a second embodiment of a temperature detection module in accordance with the present invention;

FIG. 5B is an illustration of a flowchart of one embodiment of a estimated damper temperature method in accordance with the present invention;

FIG. 6A is an illustration of a block diagram of a first embodiment of a temperature compensation module in accordance with the present invention;

FIG. 6B is an illustration of a flowchart of a first embodiment of a scale factor determination method in accordance with the present invention;

FIG. 7 is an illustration of a block diagram of a second embodiment of a temperature compensation module in accordance with the present invention;

FIG. 8A is an illustration of a block diagram of one embodiment of a compensation curve determination module in accordance with the present invention;

FIG. 8B is an illustration of a flowchart of one embodiment of a compensation data determination method in accordance with the present invention;

FIG. 9A is an illustration of a block diagram of one embodiment of a compensation parameter determination module in accordance with the present invention;

FIG. 9B is an illustration of a flowchart of one embodiment of a scale offset determination method in accordance with the present invention; and

FIG. 9C is an illustration of a flowchart of a second embodiment of a scale factor determination method in accordance with the present invention.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

FIG. 2 illustrates a MR damper controller 30 of the present invention. MR damper controller 30 comprises a conventional current command module 40, a temperature detection module 50, and a temperature compensation module 60. The modules 40, 50, and 60 can include software, hardware in the form of analog and/or digital circuitry, or a combination of software and hardware. In one embodiment, controller 30 includes an integrated processing unit (not shown) operatively coupled to one or more solid-state memory devices (not shown) storing programming corresponding to modules 40, 50 and 60 that is to be executed by the processing unit. The memory devices may be either volatile or nonvolatile and may additionally or alternatively be of the magnetic or optical variety. Besides the memory and processing unit, controller 30 additionally includes any control clocks, interfaces, communication ports, or other types of operators as would occur to those skilled in the art to implement the principals of the present invention.

Controller 30 may be employed with any configuration of a MR damper. To facilitate an understanding of the present invention, the following description of modules 40, 50, and 60 herein will be in the context of an employment of controller 30 for controlling MR damper 10 (FIG. 1).